A COMPARATIVE STUDY ON PHYSIOTHERAPEUTIC MANAGEMENT FOR PEDIATRIC FLAT FEET

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MASTER OF PHYSIOTHERAPY

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EXAMINERS :

INTERNAL EXAMINER **EXTERNAL EXAMINER**

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MAY-2019

DECLARATION

I hereby declare and present my dissertation titled

A COMPARATIVE STUDY ON PHYSIOTHERAPEUTIC MANAGEMENT FOR PEDIATRIC FLAT FEET

is the outcome of original research work was undertaken and carried out by me, under the guidance of **Prof. A.DINAKARAN, M.P.T (Pediatric Neurology),** Adhiparasakthi College of Physiotherapy, Melmaruvathur, Kanchipuram District, Tamil Nadu. I also declare that the material of this dissertation has not formed in any way the basis for the award of any other degree previously from the TamilNadu Dr. M.G.R, Medical University, Chennai.

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1. INTRODUCTION

- Flat feet also called pes planus is a deformity that occurs when the arch of the foot collapses and comes into complete or near-complete contact with the ground. The condition may be congenital (occurring at the time of birth) or acquired (developing over time,most often as a result of age or injury).

- Flatfoot (pes planus) is a medical condition in which the entire sole of the foot comes into complete or near complete contact with the ground. Although the most common form is the physiological flatfoot, the progression to a more severe grade of deformity can lead to the development of symptomatic flatfoot, which produces subjective complaints.

- The arch in the foot normally develop between the age of 3 and 6 as a baby fat pad is gradually absorbed and balance improves as skilled movements are acquired.

- In some children's the arch fails to develop ,this may be result of tightness in the calf muscle, hypermobility in the ligaments of the foot and ankle poor stability in other areas such as around the knees and hips.

- Children who present with flat feet may have been late ambulatory, may have been initially classified as toe walkers or may have been diagnosed with hypotonia when the child is standing will notice the entire foot contacting the weight bearing surface with the absence of an inner arch.

- Occasionally very young children with hypermobility may present with significant rolling in of their feet and this may affect the acquisition of walking.

- The study focuses on exercise are intrinsic and extrinsic foot muscles Strengthening, stretching for tight muscles, exercise for lower extremity and proprioception and balance exercise.

- A Properly designed exercise program to improve foot posture, The exercise are development of the arch muscles to encourage lower exterimity alignment, improve walking pattern and prevent any potential long term musculoskeletal issue.

FLAT FEET IN CHILDREN

- Flat feet(also called pes planus or fallan arch) is a postural deformity relating to the collapse or flattening of the medial longitudinal arch, it can also be referred to as hyper pronation or over pronation.

- Normally feet have an arch, but for children with flat feet ,most or all of their foot touch the floor.

DEVELOPMENT STAGES OF ARCH

- Infant are usually born with flexible flat feet at th time of birth ,a fat pad is the dominant visible structure in the region of the medial planter arch.

- During 1st decade of life, the medial longitudinal arch develops along with bone, muscles and ligament within the foot.

- By the age of 2, a child usually develops a medial arch that is visible when sitting,this arch may collapse with weight bearing, producing the appearance of flat feet.

- Flexible flatfeet usually resolves by the age of 10 yet in some patient, it persists into adolescence and adulthood. It is uncertain whether this should be considered a normal variant or a deformity that may lead to further pathology, in the absence of symptoms most others agree that flat feet is a normal.

TYPES OF FLAT FEET;

- Flat feet is common in infants and children,they are flexible flat feet, rigid flat feet.

- **Flexible flat feet** is an extremely common foot condition in children where the normal longitudinal arch of the foot upon standing is not present but arch can be seen while walking on tiptoes or upon sitting with legs hanging of the floor (when the feet are not weight bearing).

- Causes of the flexible flat feet can persist for longer in certain conditions such as obesity, family history (in heridity), secondary to a tight heel cord(Achilles tendon).

- **Rigid flat feet** its can be rigid where it can pose a problem and can occur due to problem with the foot bones, neuromuscular disorder(cerebral palsy, polio), in heridited condition.

SYMPTOMS OF FLAT FEET;

- Most of the children with flat feet have no symptoms at all. Some children may be symptomatic and can present with foot pain, difficulty walk or run, muscle exhaustion, Poor foot development, hesitation to participate in athletic activity.

  Asymptomatic : Most flat feet are asymptomatic(no difficulties associated with flat feet) and require no further evaluation or treatment.

  Symptomatic : Tightness on ankle joint, difficulty rising tiptoe, painful feet.

ANATOMY OF FOOT

The foot is terminal portion of a limb which bears weight and allow locomotion. Foot contains many bones, muscles, tendons, and other structures. Nearly one-fourth of the body's bones are in our feet.

BONES OF FOOT

- The human foot is a strong complex, its containing 26 bones and 33 joint. foot can be subdivided into the hindfoot, midfoot and forefoot.

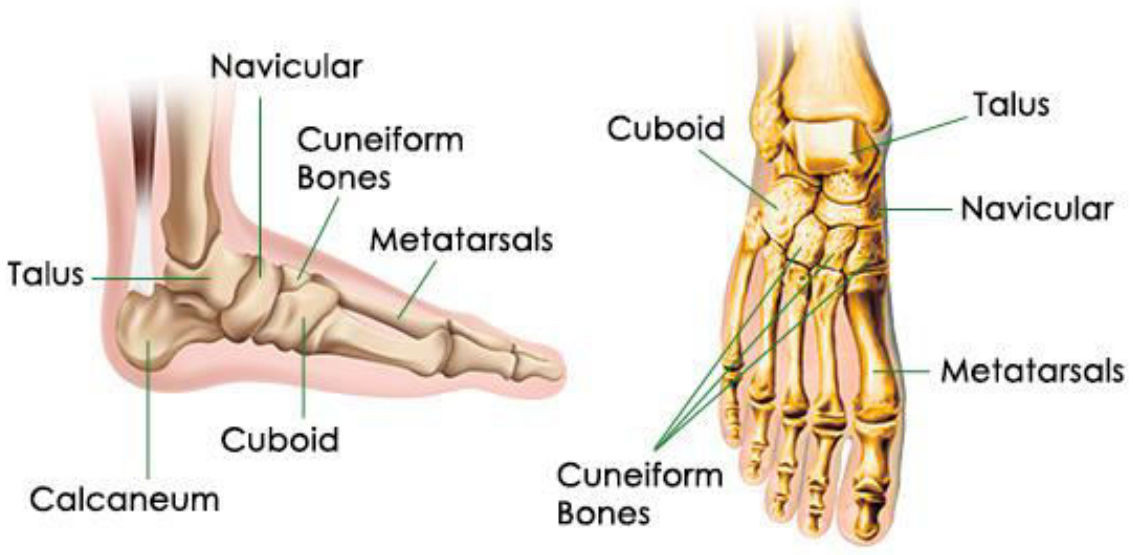


Figure.1

- Hindfoot is composed to the talus, calcaneus, two long bones tibia and fibula are connected to top of the talus.

- Midfoot is irregular bones cuboid, navicular and three cuniform bones form arches of foot which serves a shock absorber, midfoot connect the hind and forefoot by muscles and planter fascia.

- Forefoot is contains the metatarsal and phalanges. The joint between phalanges are called inter phalange and those between metatarsus and phalanges are called metatarsophalangeal.

- Bones of foot are tarsus, meta tarsus, phalanges tarsus seven bones they are calcaneus, talus, navicular, cuboid, cuniforms (medial, intermediate, lateral) metatarsus five metatarsus connect tarsus to phalanges.

  - ✓ Phalanges 1st toe has two phalanges (proximal, distal).
  - ✓ 2nd to 5th toe have three phalanges (proximal, middle, distal).

ARCH OF FOOT

Classification, arch of foot they are longitudinal arch (medial and lateral), transverse arch (anterior, posterior).

- **Medial longitudinal arch** lies higher level, more mobile and resilient than lateral. Anterior end is formed by head of 1^{st} 2^{nd} 3^{rd} metatarsal. Posterior end is formed by medial tubercle of calcaneus.

- **Lateral longitudinal arch** Limited mobility, Anterior end is formed by head of the 4^{th} 5^{th} metatarsal bones. Posterior end is formed by lateral tubercle of calcaneus.

- **Anterior transverse arch** It is formed by the head of the 5^{th} metatarsal bones, the head of the 1^{st} and 5^{th} metatarsal from the two end of the arch.

- **Posterior transverse arch** It is formed by greater part of the tarsus and metatarsus.

MUSCLES OF FOOT

- **Muscles of dorsum of foot**, Extensor digitorum brevis and Extensor halluces brevis.

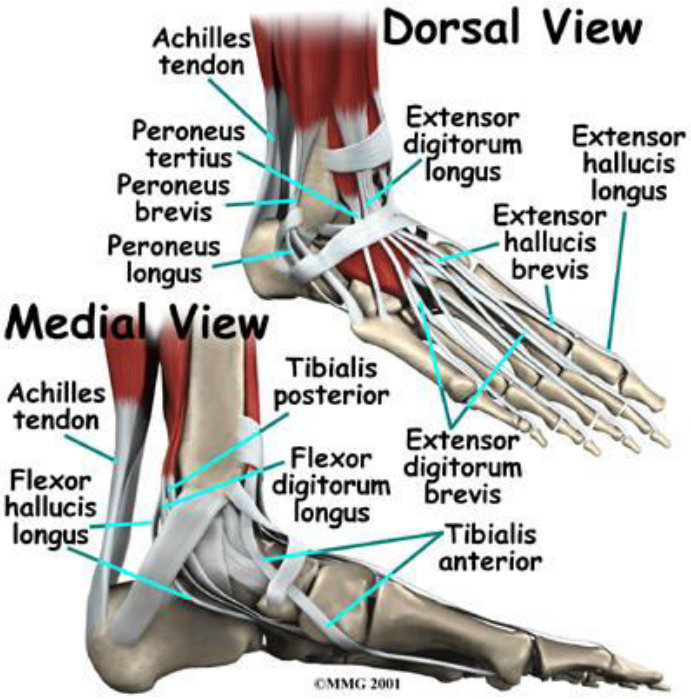


Figure.2

- **MUSCLES OF FOOT**, Planter interossei, flexor digiti minimi brevis, flexor halluces brevi, flexor diigitorum brevis, quadratus plantae (flexor accessorius) abductor digiti minimi, abductor halluces and lumbricals.

- There are 18 intrinsic muscles and extrinsic tendons in the sole of foot. The muscle of the sole are described in 4 layers from superficial deep.

- ✓ 1st layer - Flexor digitorum brevis, Abductor halluces, Abductor digiti minimi.
- ✓ 2nd layer - Flexor digitorum accessories, four lumbrical.
- ✓ 3rd layer - Flexor halluces brevis, flexor digiti minimi brevis, Abductor halluces.
- ✓ 4th layer – Interossei (3 planter interossei and 4 dorsal interossei), Tendon of tibilis posterior, Tendon of peroneus longus.

MUSCLE PRODUCING JOINT MOVEMENTS

Dorsiflexion :

- Forefoot is raise and the angle between the front of the leg and the dorsum of foot.
    - ✓ Principle muscle - Tibialis anterior
    - ✓ Accessory muscle - Extensor digitorum longus, Extensor halluces longus, Peroneus tertius.

Planterflexion:

- Forefoot is depression and the angle between the leg.
    - ✓ Principle muscle – Gastronemius Soleus
    - ✓ Accessory muscle – Plantaris Tibialis, Posterior, Flexor hallucius longus Flexor digitorum longus.

Inversion :

- It is the movement of the sole towards the median plane.
- They are two muscles produce inversion movement.
    - ✓ Tibialis Anterior, Tibialis Posterior

Eversion :

- It is the movement of the sole of the foot away from the median plane.
- Three muscles that evert the ankle.
    - ✓ Peroneus longus, Peroneus brevis, Peroneus tertius.

TENDONS OF FOOT

- Posterior tibial tendon, attach the calf muscles to the bones of the inside of the foot.
- Peroneal tendon, Achilles tendon.

LIGAMENTS OF THE FOOT

- The main ligament of the foot are; Planter fascia the longest ligament of the foot. Planter calcaneonavicular ligament a ligament of the sole of the foot that connects the calcaneus and navicular and supports the head of the talus.
- Medial ligament on the inside and lateral ligaments on outside of the foot provide Stability and enable the foot to move up and down.

NERVES OF FOOT

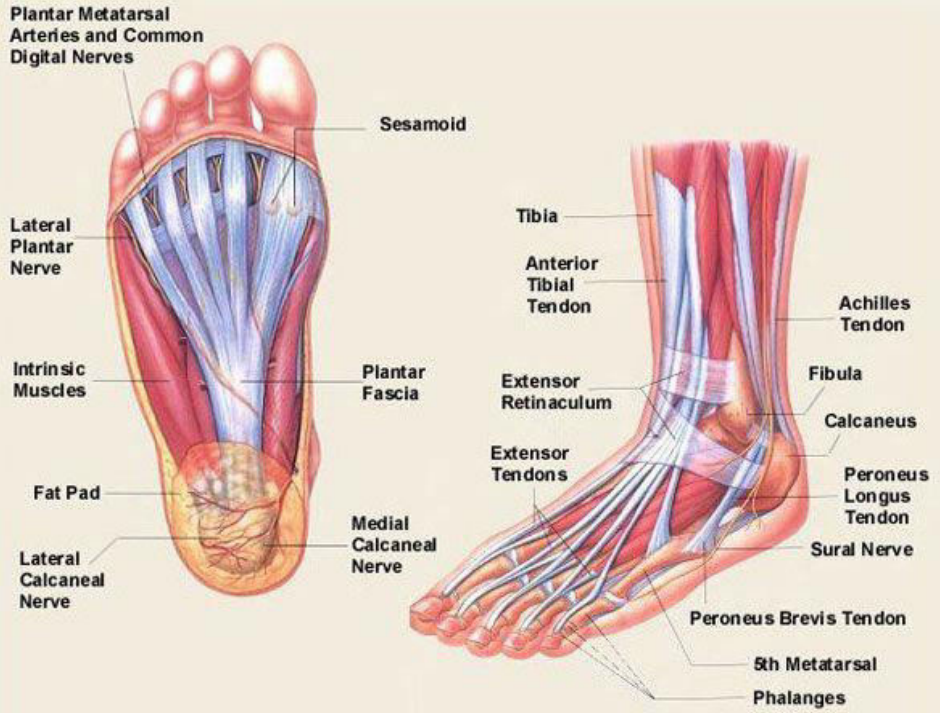


Figure.3

- **Branches of the tibial nerve:** Medial calcaneal nerve, Medial planter nerve, Lateral planter nerve.

DORSUM OF FOOT FOR SENSORY NERVE SUPPLY

- **Derived from Sural nerve** Deep peroneal nerve, Superficial peroneal nerve, Saphenous nerve.

- **Superficial peroneal nerve** Divides into medial and lateral cutaneous branches that supply the skin on the dorsum of the foot, the medial side of the big toe, and the adjacent sides of the 2^{nd}, 3^{rd}, 4^{th}, 5^{th} toe.

- **Deep peroneal nerve** Supplies the skin of the adjacent sides of the big and second toes.

- **Saphenous nerve** Passes onto the dorsum of the foot in front of medial malleolus, Supplies the skin along the medial side of the foot a far forward as the head of 1^{st} metatarsal bone.

- **Sural nerve** Enter the foot behind the lateral malleolus and supplies the skin along the lateral margin of the foot and the lateral side of the little toe.

ARTERY OF FOOT

- The Posterior tibial artery accompanies the tibial nerve and passesbehind the medial malleolus through the tarsal tunnel.

- It divides into two branches
  - ✓ Medial Planter Artery, Lateral Planter Artery.

BIOMECHANICS OF FOOT

- The foot is a key element in aligning the joints of the lower limb to achieve a normal gait pattern. The complementing structure of theankle/foot complex permit both stability and mobility depending on conditions acting on it.

- Foot is able to sustain large weight bearing stresses while accommodating to a variety of surfaces and activities.

- The foot must be stable to provide an adequate base of support and function as a rigid lever for pushing off when walking, running or jumping.

SUBTALAR JOINT

- The talocalcaneal, or subtalar, joint is a composite joint formed by three separate plane articulations between the talus superiorly and the calcaneus inferiorly.

- **Ligaments:** The subtalar joint is a stable joint that is rarely dislocated. It has a congruent osseous anatomy as well as strong ligamentous support. The subtalar joint receives support from the ligamentous structures that support the ankle, as well as from ligamentous structures that only cross the subtalar joint.

- These included from superficial to deep the calcaneofibular, posterior talocalcaneal, posterior talofibular and interosseous talocalcaneal ligaments.

- Axis of the subtalar joint inclined up from the transverse plane approximately 42° and inclined medially from an A-P axis approximately 16°

TRANSVERSE TARSAL JOINT

- The transverse tarsal joint, also called the midtarsal or Chopart joint, is a compound joint formed by the talonavicular and calcaneocuboid joints.

- The two joints together present an S-shaped joint line that transects the foot horizontally, dividing the hindfoot from the midfoot and forefoot.

TALO - NAVICULAR CALCANEO - CUBOID

Talonavicular joint

- The proximal portion of the talonavicular articulation is formed by the anterior portion of the head of the talus, and the distal portion of the articulation by the concave posterior aspect of the navicular bone.

Calcaneocuboid Joint

- The calcaneocuboid joint is formed proximally by the anterior calcaneus and distally by the posterior cuboid bone. The articular surfaces of both the calcaneus and the cuboid bone are complex, being reciprocally concave / convex both side to side and top to bottom.

Transverse Tarsal Joint Axes

- The longitudinal axis of the transverse tarsal joint is inclined 15° superiorly from the transverse plane and inclined 9° medially from the sagittal plane.The oblique axis of the transverse tarsal joint is inclined 57° from the sagittal plane and inclined 52° superiorly from the transverse plane.

TARSOMETATARSAL JOINTS

- **Tarsometatarsal (TMT) joints** are plane synovial joints formed by the distal row of tarsal bones (posteriorly) and the bases of the metatarsals. Thefirst (medial) arsometatarsal joint is composed of the articulation between the base of the first metatarsal and the medial cuneiform bone.

- The second tarsometatarsal joint is composed of the articulation of the base of the second metatarsal with a mortise formed by the middle cuneiform bone and the sides of the medial and lateral cuneiform bones. This joint is set more posteriorly than the other tarsometatarsal joints; it is stronger and its motion is more restricted.

- The third tarsometatarsal joint, formed by the third metatarsal and the lateral cuneiform. The bases of the fourth and fifth metatarsals, with the distal surface of the cuboid bone, form the fourth and fifth tarsometatarsal joints.

Tarsometatarsal Joint Function

- The greatest relevance of tarsometatarsal joint motions is found during weight-bearing. In weight-bearing, the tarsometatarsal joints function primarily to augment the function of the transverse tarsal joint. That is, the tarsometatarsal joints attempt to regulate position of the metatarsals and phalanges (the forefoot) in relation to the weight-bearing surface.

Pronation – The three body plane motions in pronation are abduction in the transverse plane, dorsiflexion in the sagittal plane, and eversion in the frontal plane .

Supination – The three body plane motions in supination are a combinedmovement of adduction, plantarflexion, and inversion.

Supination Twist

- When the hind foot pronates substantially in weight bearing, the transverse tarsal joint generally will supinate to some degree to counter rotate the forefoot and keep the plantar aspect of the foot in contact with the ground.

- If the range of transverse tarsal supination is not sufficient to meet the demands of the pronating hind foot then the medial forefoot will press into the ground, and the lateral forefoot will tend to lift.

- The first and second rays will be pushed into dorsiflexion by the ground reaction force, and the muscles controlling the fourth and fifth rays will plantar flex those tarsometatarsal joints in an attempt to maintain contact with the ground. Both dorsiflexion of the first and second rays and plantar flexion of the fourth and fifth rays include the component motion of inversion of the ray. Consequently, the entire forefoot (each ray and its associated toe) undergoes an inversion rotation. This rotation is referred to as supination twist of the tarsometatarsal joints.

Pronation Twist

- Hindfoot supination, the forefoot tends to lift off the ground on its medial side and press into the ground on its lateral side. The muscles controlling the first and second rays will plantarflex those rays in order to maintain contact with the ground, whereas the fourth and fifth rays are forced into dorsiflexion by the ground reaction force Because eversion accompanies both plantarflexion of the first and second rays and dorsiflexion of the fourth and fifth rays, the forefoot as a whole undergoes a pronation twist.

METATARSOPHALANGEAL JOINTS

- The five metatarsophalangeal (MTP) joints are condyloid synovial joints with two degrees of freedom extension / flexion or (dorsiflexion / plantarflexion) and abduction / adduction.

- The metatarsophalangeal joints are formed proximally by the convex heads of the metatarsals and distally by the concave bases of the proximal phalanges. Metatarsophalangeal motions can occur in weight-bearing or non- weight bearing, the metatarsophalangeal joints serve primarily to allow the weight-bearing foot to rotate over the toes through metatarsophalangeal extension (known as the metatarsal break) when rising on the toes or during walking.

- The metatarsal break derives its name from the hinge or “break” that occurs at the metatarsophalangeal joints as the heel rises and the metatarsal heads and toes

remain weight bearing. The metatarsal break occurs metatarsophalangeal extension around a single oblique axis that lies through the second to fifth metatarsal heads.

- The metatarsal break occurs around an oblique axis that passes through the heads of the four lesser toes, at an angle to the long axis of the foot that varies widely among individuals from 54° to 73°. 54-73 degree.

INTERPHALANGEAL JOINTS

The interphalangeal (IP) joints of the toes are synovial hinge joints with one degree of freedom: flexion/extension. The great toe has only one interphalangeal joint connecting two phalanges, whereas the four lesser toes have two interphalangeal joints (proximal and distal interphalangeal joints) connecting three phalanges.

PATHOMECHANICS OF FOOT

- Pathomechanic compensation that occur from foot abnormalities during weight bearing tasks.The 3 foot abnormalities calcaneal (Rear foot) varus, forefoot varus, forefoot valgus.

- The foot can be simplified into structure that has job;mobility (pronation) and stability (supination). It require adequate mobility to adapt to ground surface and facilitate shock absortion.

- Pathomechanics of Medial Longitudinal Arch Pes Cavu, Pes cavus is a high arch that does not flatten with weight bearing. deformity can be located in forefoot, midfoot, or hindfoot or in a combination of these sites.

- Pathomechanical Causes clawing of toes posterior hind foot deformity (described as an decreased calcaneal angle),Contracture/tightening of the plantar fascia cock-up deformity of the great toe.This can cause increased weight bearing for the metatarsal heads and associated metatarsalgia and callus formation.

- Pathomechanics due to Pes Cavus Foot is inverted Calcaneus inverted/varus Big toe usually plantar flexed and other toes dorsiflexed at metatarsophalangeal joint resulting in claw foot deformity During gait thearch is not depressed even in foot flat phase resulting in loss of adaptation to uneven surfaces lateral foot pain from increased weight bearing on the lateral foot.

- Metatarsalgia Ankle instability can be a presenting symptom, especially in patients with hind foot varus and weak peroneus brevis muscle. Patients with neuromuscular disease complain of weakness and fatigue.

- Pes Planus Flatfoot may be classified as congenital or acquired. Congenital flatfoot can be further divided into rigid and flexible. Congenital rigid flatfoot is due to a structural bony abnormality such as vertical talus Congenital flexible flatfoot is mostly physiological, asymptomatic and requires no treatment.

- Pathomechanical Causes Posterior tibial tendon dysfunction (PTTD). This tendon is vital to the maintenance of the medial arch. Attenuation or rupture of the PTTD tendon will cause a flatfoot deformity Tarsal coalition. This is a congenital condition where bones in the midfoot and hindfoot are abnormally joined together. This causes a reduced range of movement and the transfer of mechanical forces to other joints causing pain.Peroneal spastic flatfoot is a name given to flatfoot deformity with increased tone in the peroneal muscles. These muscles evert the foot and disrupt the balance of muscular pull around the ankle

- Pathomechanics due to Pes Planus Charcot foot. This is flatfoot, sometimes a rocker bottom foot, associated with a peripheral neuropathy. (Lax Plantar Fascia)The heel bone, when viewed from rear is everted or in valgus.Flatfeet may cause, other biomechanical causes of pain for example, genu valgum (knock knees), medial or anterior knee pain, Achilles tendonitis, and low back pain During Heel Srtrike in the gait cycle the longitudinal arch is not present , thus not able to provide a rigid foot for weight transmission Foot is everted, Forte foot is Abducted and pronated.

- This causes the Big toe to abduct and go into a valgus position resulting in Hallux Valgus Deformity weight transmission is displaced from head of 1st metatarsal to head of 2nd and 3rd metatarsal resulting in an abnormal weight bearing Metatarsal head's lateral surface in Big toe valgus deformity rubs against the shoe and results in callus formation.

    - ✓ Arches of the Foot
    - ✓ Arch Positions Normal High arch: Pes cavus
    - ✓ Low arch (flat foot): Pes planus

- Ankle Joint Stability Distal ends of tibia and fibula like mortise (pinchers) of adjustable wrench Tibia is weight bearing Fibula is considered non- weight bearing may hold up-to 10% of body weight Multiple ligaments Movements & Major Muscles.

AIM OF THE STUDY

To compare the effectiveness between home exercise program and physiotherapeutic treatment for flat feet in children's.

NEED FOR STUDY

Flat feet is common in infants and children and often resolves by adolescence. In children 2 years or younger, morely found a 97% prevalence of flat feet. There are only few studies on the strengthen the foot muscles on the flat feet in children.

However ,there is no prospective study more effective to evaluate physiotherapeutic management for lengthen and strengthen the muscles of foot, shoes and insoles lift the arch of foot.

HYPOTHESIS

NULL HYPOTHESIS

There is no significant different between the effectiveness of home exercise program compared to physiotherapeutic management in treating children's with flat feet.

ALTERNATE HYPOTHESIS

There is significant different between the effectiveness of home exercise program compared to physiotherapeutic management in treating children's with flat feet.

2. REVIEW OF LITERATURE

SM Javad Mortazavi et al.,June 2007, conducted a study on Flatfoot in children How to approach ? And found that Shoe-wearing before the age of six would predispose to flat foot whereas if it were delayed until the child was older, the propensity for flat foot would be less.

Flexible flat foot in a child almost never causes any problem. Flexible flatfoot may become symptomatic in adolescents. Symptoms begin to develop as contracted Achilles tendon limits full ankle dorsiflexion, thus transferring force to the mid foot. Over time, these forces result in the breakdown of the tarsal joints. Patients complain of vague pain in the medial arch and ankle.

Umar and Adeyemi Paul., 2010 conducted a study on the incidence of flat foot and anthropometric comparision between Flat and normal foot of the Yoruba ethnic group of Nigeria. The aim the study was to determine the incidence of the flat foot amongst school aged children and also determine foot anthropometry with respect to age and gender.

The overall incidence of flat foot was 25% with incidence of 13% among males and 12% among females. The study showed that flat foot has high incidence among school aged children with males having higher incidence then females.

Cilli F, Pehlivan O, et.al, 2009. Conducted a study on Prevalence of flatfoot in Turkish male adolescents The study was carried out in a high school in Istanbul in July 2006. Twenty-two subjects with flatfoot were diagnosed among 3169 male adolescent participants. Prevalence of flatfoot was evaluated statistically in this certain age and gender group.

Correlation of flatfoot with weight and height were evaluated. The results of the study revealed that the Prevalence of flatfoot was found to be 0.69%. Correlation of flatfoot with weight or height was not significant.

Hassan Daneshmandi, Nader Rahnema, et.al, 2009. This study was done to determine the relationship between obesity and flatfoot among high school students. 1180 students of age between 12 to 15 years were selected based on cluster random sampling. Height and weight of subjects were measured by using standard apparatus.

BMI was considered as the index of obesity. The international BMI cut-off values were used to determine obesity and foot structure assessment was performed with Denis method. A significant difference was found between obesity and flat foot and age in boys and girls in age 12-15 years, but for 16 and 17 years no significant difference was observed.

In conclusion, the result of this study suggest increasing of weight a temporarily, may cause existence significant difference in the prevalence of flat foot among high school boys and girls in age 12-15 years.

Ilona Mihajlović, Ivan Toncev et.al, 2008. Did a study on prevalence of flatfoot deformity in boys depending on their age in this study a scientific measurement of the foot deformity in 287 pre-school children age between 4 to 7 years was done.

The obtained results indicated the great prevalence of deformity so the conclusion was drawn that the deformities are most frequent in the group of 4 to 7 year old boys.

Jullie Allen and Sharon Solan, The 4 to 10 year old children randomly selected , diagnosis and severity of flatfoot was assessed in using the denis method,physiotherapy exercise are strengthening for foot muscles,proprioception and balance,.The prevalence of flexible flat feet decreases with age.

AbolarinTO, AiyegbusiAI et al., 2011. This study investigated the effect of nutritional status as indicated by factors such as height, weight and BMI on the prevalence of flatfoot in school age children in urban and rural areas in south-western Nigeria. Involved 560 children with age range 6 to 12 years. Anthropometric measurement were significantly higher in urban than in rural children. Nutritional status of urban children was also significantly higher than that of the rural children.

Flatfoot is more prevalent in school age children in urban area than in the rural area; age and body mass index being the primary predictors for flatfoot.

Arnaldo Jose Hernandez et al.,2007. The author's studied 100 normal children of both genders with age ranging from 5 to 9 years old, in order to evaluate the plantar arch index and the flat feet prevalence. The flat feet evaluation was obtained by means of the footprint and the plantar arch index (IP), which establishes the ratio between central and posterior regions of this footprint, determining a mean IP and a limit to the flat –foot.

They conclude that the plantar arch index is easy to obtain from foot prints and that there are no differences in term of gender / age. From the IP analysis, significant differences were noted between both sides, with average plantar indexes being 0.67 for right side and 0.61 for left side Based on this sample, plantar arch indexes above 1.15 should be regarded as indicative of flat foot.

C.I. Ezema, MSc et al., 2013. Prevalence of flat foot and its associated personal characteristics among public primary school students was investigated This cross-sectional study involved 474 public primary school students.

Flat foot diagnosis was made using Staheli plantar index (PI), There was a significant relationship between higher prevalence of pes planus and older age, with the 6-year-old group showing the highest prevalence.

Boys were twice as likely to be diagnosed with flat foot as girls, and obese participants were three and a half times more likely to have flat foot compared with those of a normal weight. In summary, about one in every five public primary school children aged 6–10 years would be diagnosed with flat foot anomaly, and obesity further increased the risk.

Pre registration flat foot screening, and observation for onset of symptoms of progression, should be made available for primary school children.

Cavanagh PR, Rodgers MM.,1987. Previous methods of measuring footprints for the purpose of classifying foot type are reviewed. A planimetric method is presented for characterizing footprints using the ratio of the area of the middle third of the footprint to the entire footprint area (excluding the toes).

This 'arch index' during 50% body weight standing provides an objective measure for comparative purposes with a measured reliability, within day and between day, of 0.96 and 0.94 respectively.

Values measured from footprints taken during other activities show variable responses in different subjects. Examples of the arch index taken from static footprints of various feet are presented and data are reported from 107 randomly selected subjects during half body weight stance. Criteria are suggested for the classification of footprints as high, normal, and flat arch.

Nematollah Kamali, Mehrdad Farsi, Nabiollah Soltanpour This study was to analyze the relation between the flat-footedness and obesity. A total of 1158 school children (653 male and 505 female) participated in this cross sectional descriptive study, children were divided into three groups for each gender 6 to 12years old,diagnosis and severity of flatfoot was assessed in using the denis method. BMI of children were calculated as body weight divided by height squared.

The prevalence of flatfoot was 16.1% with decreasing trend with age. Boys had a higher frequency of flatfoot than girls; however the difference was not significant ($p > 0.05$). The prevalence of flatfoot was 17.5% inboys and 14.5% in girls. The percentage of overweight and obese children was 10.3%.

A significant difference in the prevalence of flatfoot occurred between; under-weight , normal-weight. The increasing prevalence of childhood obesity is one of the most serious health challenges across the globe, and a positive correlation between increased BMI; and flatfoot is one of the potential complications.

3. METHODOLOGY

STUDY DESIGN : Quasi Experimental Study

STUDY SETTING : Star hospital ,34/64 Durgai Amman Koil Street, Tiruvannamalai – 606601

DURATON OF STUDY : The study is undertaken totally in 2 months with 40 Session for each children.

POPULATON : School going children from 1st standard to 6th standard

STUDY SIZE : 30 Subject with Flat feet in children's.
(33 Children's are selected for the study but 3 children's dropped out for sick)

SAMPLING METHOD : The Primary School children's are randomly Selected.

- They are divided in two groups by using home exercise program and physiotherapeutic management.

INCLUSION CRITERIA : Age group between 6 to 12 years

- Both gender involvement.
- Cooperative children's

EXCLUSION CRITERIA : Uncooperative children's

- Recent fracture of lower limp
- Fever
- Children with associated musculoskeletal deformaties
- Children with neurological anamolies.

MEASUREMENT TOOLS : Denis Method

MATERAL USED :

- Stamp Pad
- White Paper
- Inch Tape
- Therapy Ball / Exercise Ball
- Tactile Ball
- Scarf
- Towel
- Glass Bowel
- Glass stones
- Foam Roller
- Balance Pod
- Dyna Disc
- Foot Roller
- Ball
- Pillows

Figure.4

4.METHOD/ PROCEDURE

- All the childrens will be selected into the study based on inclusion criteria.
- Informed consent will be taken from the parent for the child to participate into the study.
- This study included 30 children aged between 6 to 12 years. The subject will be divided into two groups A and B groups of 15 each.
- The first group will be treated with home exercise program while the other group will be treated with physiotherapeutic management.
  .
- Out come measure before and after the treatment by using Denis method measure the fore foot width and mid foot width will be calculated for the grade of flat feet.

TREATMENT TECHNIQUES

GROUP A : HOME EXERCISE PROGRAM

SCARF LIFT AND RELEASE

- Using scarf start with material flat on floor.
- The position of child seated or standing.

Figure.5

- Encourage child to place one foot on top and use muscles of foot tolift scarf up and release.
- Repeat the exercise 10 times and 3 sets for per day.

TOE BASKETBALL

- The position of child should be seated in chair.

Figure.6

- Child pick up object with toes and drop in small container, this requires greater control and prolongs muscle activation.

- Ask child to drop the 10 to 15 objects in small container.

- Repeat the exercise 3 sets in a day.

HEEL WALKING

- Instructed to Child should be in standing position.

- Encourage child to walk forward with heels on the ground and toes up.

Figure.7

- Ask the child to walk 10 meter distance.
- Repeat the exercise 3 sets in a day.

FOOT ROLLER

- Child should be in seated position.
- Place the foot roller under the child foot and roll it back and forth with the arch of foot.
- Duration of exercise 5 to 10 minutes

Figure.8

- Repeat the exercise 3 sets in a day.

TOE CURLS

- Child sit up straight in a chair with towel place under forefoot.
- Ask the child curl and release toes so as to pull the towel towards themself.

Figure.9

- Keep the heel on the ground, To progress place a weight on the towel.
- Encourage child to do toe curls for 10 repetation and 3 sets in a day.

INSTRUCTION FOR HOME PROGRAM

- Ask the child to walk on different surfaces such as sand ,grass, through water and up and down slops
- All exercises should do regularly at home by parent assist.
- Shoes and insole suggestion to improve foot position.

GROUP B : PHYSIOTHERAPEUTIC MANAGEMENT

GENTLE FOOT MASSAGE

- Child should be comfortable lying position.
- Therapist should hold the child foot.

Figure.10

- Apply gentle pressure to bottom of children foot.
- Use circular motion activate muscles of medial foot.
- Duration of foot massage 5 to 10 minutes and weekly 5 session.

VIBRATION OR TACTILE INPUT

- Use vibrating node or tactile ball along arch of foot with child comfortably seated to activate muscles of foot.

Figure.11

- Therapist should apply gentle roll using tactile ball on the medial side of foot.
- Duration of treatment 5 to 10 minutes and weekly 5 session.

BALL JUMPS

- The therapist should be in standing position.
- Have child stand top a therapy ball secured in corner of a wall.
- The therapist hold child hand and allow them to jump up and down to encourage proprioceptive input to their feet and ankles.

Figure.12

- Duration of ball jump 5 to 10 minutes and weekly 5 session

BALANCE CHALLENG

- Child should be in standing position.
- Ask the child to stand on the balance pods and ask child to lift he's both hand.
- Challenge child to a balance off! See child can balance the longest while standing on these balance pods.

Figure.13

- The duration of balance pod standing 5 to 10 minutes and weekly 5 session.

DYNA DISC BALANCE

- Ask the child to stand on the dyna disc with both legs.

Figure.14

- Maintain balance on dyna-disc during game of catch.
- Duration of dyna disc balance exercise 10 minutes and weekly 5 session.

SINGLE LEG BALANCE ON DYNA DISC

- Ask the child to stand on the dyna disc with single leg.
- Maintain balance on dyna-disc during game of catch.

Figure.15

- Duration of dyna disc balance exercise 10 minutes and weekly 5 session.
- Single leg balance on dyna-disc for extra challenge of muscles of lower extremity.

HALF MOON BALANCE

- Ask the child to stand on the foam roller with support.

Figure.16

- Stand to foam roller also great for arch activation.
- Duration of half moon balance exercise 5 to 10 minutes and weekly 5 session.

PLANTER FASCIA STRETCH

- Child should be standing position.
- Ask the child to place the feet against a wall and keep arches and heel as flat as possible so that toes can stretch.

Figure.17

- Child can also place a tennis ball in front for more support.
- Hold the stretch for 10 second for 10 repetation and weekly 5 sessions.

PILLOW WALKS

- Position of therapist should be standing position with child.

Figure.18

- Line up 2-3 large pillow or couch cushions, encourage child to walk along with support for balance.
- Duration of pillow walking 5 to 10 minutes and weekly 5 session.

SHOES AND INSOLE SUGGESTION FOR CHILDREN WITH FLAT FEET

Supportive shoes - Encourage child to wear structurally supportive shoes instead of sandals, fli-flops and shoes without arch support.

Arch support/Insole - Recommend arch support orthotic devices that fit inside child's shoes to relieve pain and reduce symptoms.

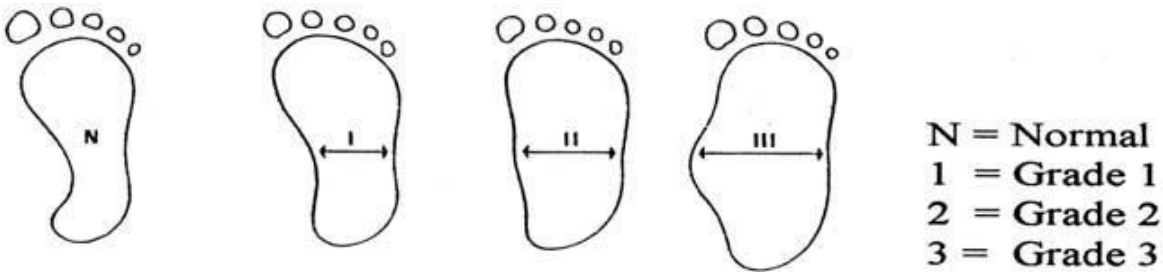
TOOL DESCRIPTION

DENI'S METHOD

To assess static plantar foot print, each subject stood barefoot and relaxed in the anatomical position, adopting the same posture used to collect foot print data by chalking the sole of the foot and making an impression of it on paper.

The student will be asked to wash their foot which will be properly dried after. Their feet will be impregnated with the stamp ink pad and the impression will be taken using the white paper. The planter footprint will be calculated by denis method.

Denis et al(1974)& Garcia-Rodrigeuz et al (1999)



Grade 1 – The support of the lateral edge of the foot is half that of the metatarsal support.

Grade 2 - The support of the central zone and forefoot are equal.

Grade 3 - The support of the central zone of the foot is greater than the width of the metatarsal support.

In this study, we defined those children who displayed a second or third degree plantar footprint as flatfoot Children with first degree plantar footprints were not included in this study, because they were considered to have evolutionary foot problems without pathologic significance according to Meary and Stewart [19, 20].

5 .DATA ANALYSIS AND INTERPRETATION

STATISTICAL METHOD

The data was analysed by paired t- test. The collected tabulated and analyzed by using descriptive and inferential statistics. The statistical package for calculated and analyze the above mentioned descriptive and inferential statistics.

- ✓ To assess all parameters descriptive statistics like mean and standard deviation were used.

- ✓ Used for analyze within the group A and group B

$$\frac{\bar{d}\ \sqrt{n}}{S}$$

where $S = \sqrt{\frac{\Sigma d^2 - \frac{(\Sigma d)^2}{n}}{n-1}}$

d = Difference between the Pre Test Vs Post Test

$\bar{d}$ = Mean difference

n = Total number of subjects

S = Standard deviation

UNPAIRED "t" TEST:

Used for analyze between the group A and group B

$$S = \sqrt{\frac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2}}$$

$$t = \frac{\left| \overline{x_1} - \overline{x_2} \right|}{s \sqrt{1/n_1 + 1/n_2}}$$

n_1 = Total number of subjects in group A

n_2 = Total of subjects in group B

x_1 = Difference between pre test and post –test of group A

$\overline{x_1}$ = Mean difference between pre test and post test of Group A

x_2= Difference between pre-test and post test of Group B

$\overline{x_2}$= Mean difference between pre-test and post test of Group B

Mann-Whitney U Test

Mann-whitney U test is the non-parametric alternative test to the independent sample t-test.

$$U_1 = R_1 - \frac{n_1(n_1 + 1)}{2}$$

or

$$U_2 = R_2 - \frac{n_2(n_2 + 1)}{2}$$

U= Mann-Whitney U Test

n_1 =Sample Size one

n_2 = Sample Size Two

R_1 =Rank of the sample size

The U test I included in most modern statistical packages which do the calculations

Group A:

1.Table showing comparison of pretest and posttest value of fore foot and mid foot width measurement using Denis method

Paired Samples Statistics						
FORE FOOT & MID FOOT		Mean	N	Std. Deviation	Std. Error Mean	T value
Pair 1	PRE RT FEET FORE FOOT	5.6933	15	1.16770	.30150	7.597**
	POST RT FEET FORE FOOT	5.5200	15	1.20250	.31048	
Pair 2	PRELT FEET FORE FOOT	5.9800	15	.96968	.25037	5.219**
	POST LT FEET FORE FOOT	5.7733	15	1.05320	.27194	
Pair 3	PRE LT FEET MID FOOT	4.7133	15	1.05551	.27253	6.609**
	POST LT FEET MID FOOT	4.3733	15	1.01662	.26249	
Pair 4	PRE RT FEET MID FOOT	4.7000	15	1.69664	.43807	5.286**
	POST RT FEET MID FOOT	4.4533	15	1.66599	.43016	

The analysis within group- A was done using paired t- test for 0 to 2 months. The results revealsed significant improvement within group A. Therefore Home exercise program was improving foot muscle strengthening and foot posture to the children's within group A.

Significant = **P<0.001

Not Significant = **P>0.001

Group B:

2. Table showing comparison of pretest and posttest value of fore foot and mid foot width measurement using Denis Method

Paired Samples Statistics					
FORE FOOT & MID FOOT		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRERT FEET FORE FOOT	5.9333	15	1.51736	.39178
	POST RT FEET FORE FOOT	4.9067	15	1.32798	.34288
Pair 2	PRELT FEET FORE FOOT	5.8267	15	1.54802	.39970
	POSTLT FEET FORE FOOT	4.8533	15	1.20527	.31120
Pair 3	PRELT FEET MID FOOT	5.2200	15	1.61873	.41795
	POSTLT FEET MID FOOT	4.2133	15	1.32442	.34196
Pair 4	PRERT FEET MID FOOT	4.6200	15	1.19833	.30941
	POST RT FEET MID FOOT	3.6733	15	1.08395	.27988

The analysis within group- B was done using paired t- test for 0 to 2 months. The results revealsed significant improvement within group B.

Therefore Physiotherapeutic management was improving foot muscle strengthening and foot posture to the children's within group B.

Significant = **P<0.001

Not Significant = **P>0.001

3.Comparison of pre and post testing for Group A and Group B (Fore foot and Mid foot width- Inch Tape Measurement value) by using Denis method

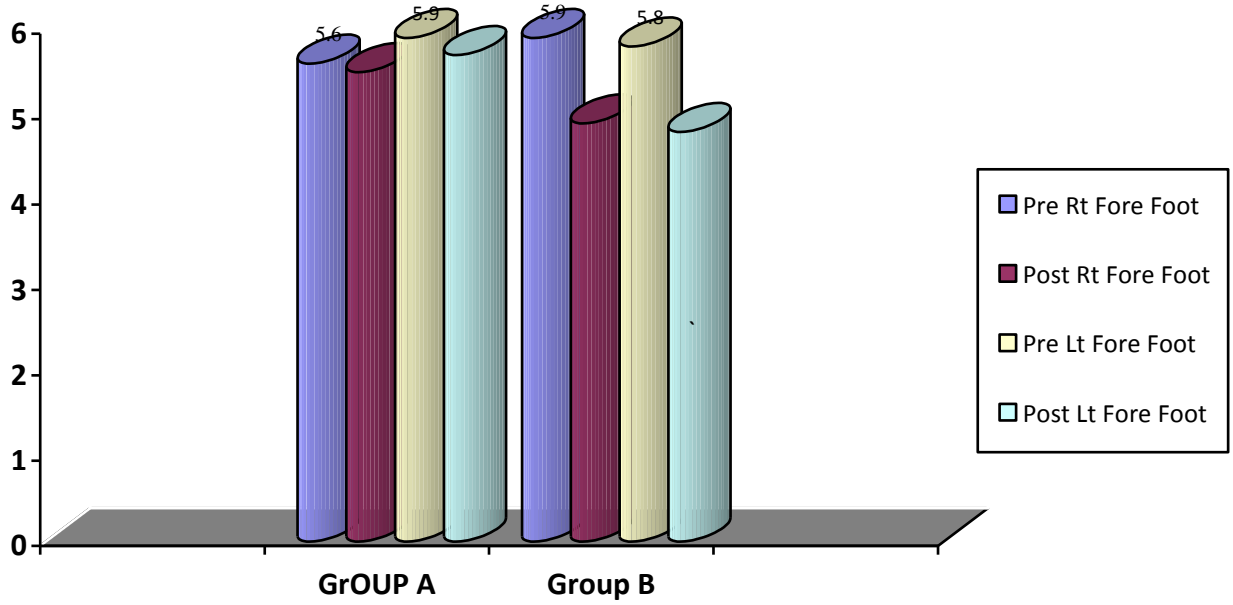
Group Statistics							
FORE FOOT & MID FOOT	GROUP	N	Mean	Std. Deviation	Std. Error Mean	T VALUE	P VALUE
PRE RT FEET FORE FOOT	GROUP A	15	5.6933	1.16770	.30150	-.485	.631
	GROUP B	15	5.9333	1.51736	.39178		
PRE LT FEET FORE FOOT	GROUP A	15	5.9800	.96968	.25037	.325	.748
	GROUP B	15	5.8267	1.54802	.39970		
POST RT FEET FORE FOOT	GROUP A	15	5.5200	1.20250	.31048	1.326	.196
	GROUP B	15	4.9067	1.32798	.34288		
POST LT FEET FORE FOOT	GROUP A	15	5.7733	1.05320	.27194	2.226*	.034
	GROUP B	15	4.8533	1.20527	.31120		
PRE RT FEET MID FOOT	GROUP A	15	4.7000	1.69664	.43807	.149	.882
	GROUP B	15	4.6200	1.19833	.30941		
PRE LT FEET MID FOOT	GROUP A	15	4.7133	1.05551	.27253	-1.015	.319
	GROUP B	15	5.2200	1.61873	.41795		
POST RT FEET MID FOOT	GROUP A	15	4.4533	1.66599	.43016	1.520	.140
	GROUP B	15	3.6733	1.08395	.27988		
POST LT FEET MID FOOT	GROUP A	15	4.3733	1.01662	.26249	.371	.713
	GROUP B	15	4.2133	1.32442	.34196		

The analysis between group –A and group-B was done using unpaired t-test for a 0 to 2 months. The result shows that there are no significant difference in home exercise program group as compared to physiotherapeutic management group.

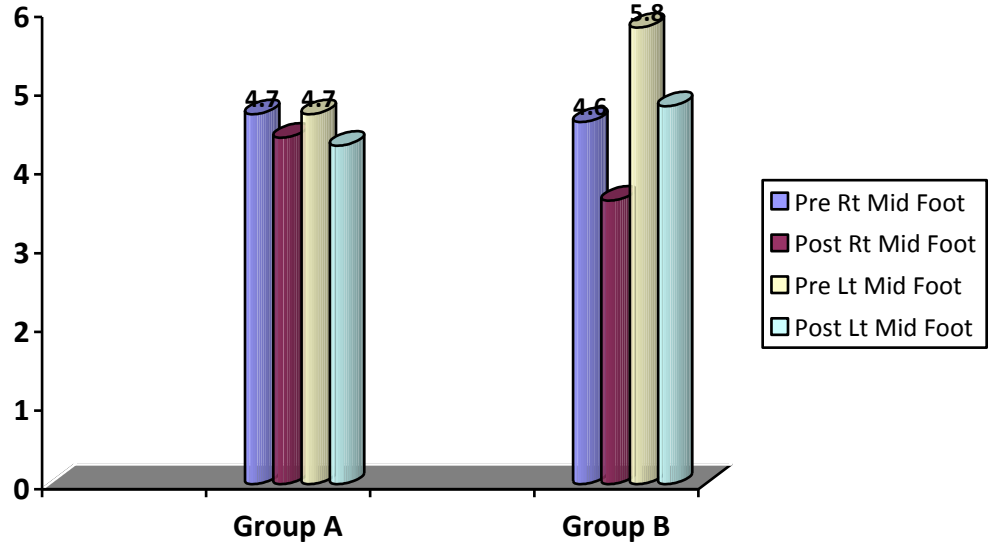
Significant = *P<0.05

Not Significant = *P>0.05

1. **Comparison of Group A and B Graphical representation of Right and Left Fore Foot value for pre and post test**



2. **Comparison of Group A and B Graphical representation of Right and Left Mid Foot value for pre and post**



4.Table showing comparison of Group A and Group B pretest and posttest for using Denis method grade value Data collection

DENIS METHOD GRADE (N .1 .2 .3)					
S.N0	**GROUP**	**PRE- RT FEET**	**PRE-LT FEET**	**POST-RT FEET**	**POST- LT FEET**
1	GROUP A	1	1	1	1
2	GROUP A	2	1	2	1
3	GROUP A	2	2	2	2
4	GROUP A	N	1	N	1
5	GROUP A	3	2	3	2
6	GROUP A	3	2	3	2
7	GROUP A	2	1	2	1
8	GROUP A	3	2	3	2
9	GROUP A	1	N	1	N
10	GROUP A	1	1	1	1
11	GROUP A	2	2	2	2
12	GROUP A	2	3	2	3
13	GROUP A	2	3	2	3
14	GROUP A	2	2	2	2
15	GROUP A	N	1	N	1
16	GROUP B	1	1	1	2
17	GROUP B	3	2	3	2
18	GROUP B	1	1	1	1
19	GROUP B	1	2	1	3
20	GROUP B	2	3	2	3
21	GROUP B	3	2	3	2
22	GROUP B	3	3	3	3
23	GROUP B	N	1	N	1
24	GROUP B	1	1	1	1
25	GROUP B	1	2	1	2
26	GROUP B	2	3	2	3
27	GROUP B	N	1	N	1
28	GROUP B	1	2	1	2
29	GROUP B	1	3	1	3
30	GROUP B	2	1	2	1

5.Comparison of Group A and Group B Right feet for Pre testing by using Denis Method

PRE RT FEET DENIS METHOD * GROUP Cross tabulation					
DENIS METHOD N,1,2,3			GROUP		
			GROUP A	GROUP B	Total
PRE RT FEET DENIS METHOD	N	Count	2	2	4
		% within GROUP	13.3%	13.3%	13.3%
	GRADE 1	Count	3	7	10
		% within GROUP	20.0%	46.7%	33.3%
	GRADE 2	Count	7	3	10
		% within GROUP	46.7%	20.0%	33.3%
	GRADE 3	Count	3	3	6
		% within GROUP	20.0%	20.0%	20.0%
Total		Count	15	15	30
		% within GROUP	100.0%	100.0%	100.0%

Mann-Whitney U =92.50 ;Z=0.866 P=0.386

The analysis between group –A and group-B was done using Mann-Whitney U test for the result shows that there are non significant.

6.Comparison of Group A and Group B Left feet for Pre testing by using Denis Method

PRE LT FEET DENIS METHOD * GROUP Cross tabulation					
DENIS METHOD N,1,2,3			GROUP		
			GROUP A	GROUP B	Total
PRE LT FEET DENIS METHOD	N	Count	1	0	1
		% within GROUP	6.7%	.0%	3.3%
	GRADE 1	Count	6	6	12
		% within GROUP	40.0%	40.0%	40.0%
	GRADE 2	Count	6	5	11
		% within GROUP	40.0%	33.3%	36.7%
	GRADE 3	Count	2	4	6
		% within GROUP	13.3%	26.7%	20.0%
Total		Count	15	15	30
		% within GROUP	100.0%	100.0%	100.0%

Mann-Whitney U =95.00 ;Z=0.774 P=0.439

The analysis between group –A and group-B was done using Mann-Whitney U test for the result shows are non significant.

7.Comparison of Group A and Group B Right feet for Post testing by using Denis Method

POST RT FEET DENIS METHOD * GROUP Cross tabulation					
DENIS METHOD N,1,2,3			GROUP		
			GROUP A	GROUP B	Total
POST RT FEET DENIS METHOD	N	Count	2	2	4
		% within GROUP	13.3%	13.3%	13.3%
	GRADE 1	Count	3	7	10
		% within GROUP	20.0%	46.7%	33.3%
	GRADE 2	Count	7	3	10
		% within GROUP	46.7%	20.0%	33.3%
	GRADE 3	Count	3	3	6
		% within GROUP	20.0%	20.0%	20.0%
Total		Count	15	15	30
		% within GROUP	100.0%	100.0%	100.0%

Mann-Whitney U =92.50 ;Z=0.866 P=0.386

The analysis between group –A and group-B was done using Mann-Whitney U test for the result shows are non significant.

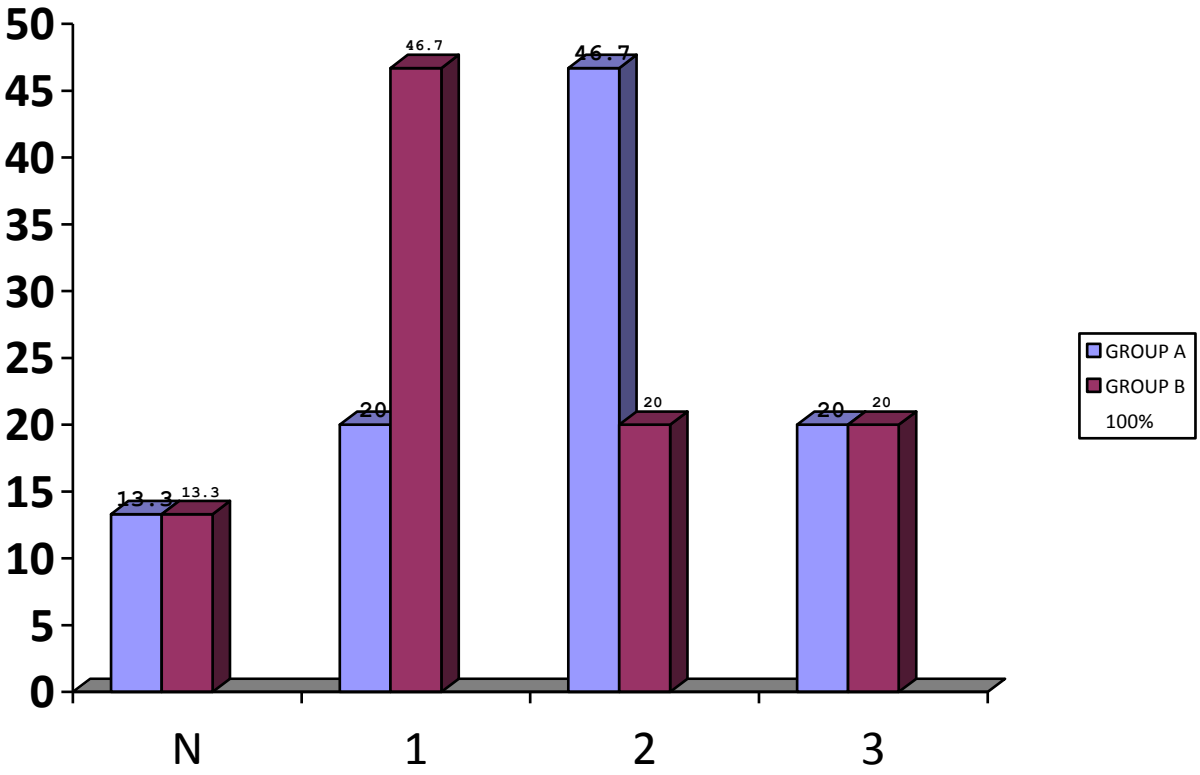
8.Comparison of Group A and Group B Left feet for Post testing by using Denis Method

POST LT FEET DENIS METHOD * GROUP Cross tabulation					
DENIS METHOD N,1,2,3			GROUP		
			GROUP A	GROUP B	Total
POST LT FEET DENIS METHOD	N	Count	1	0	1
		% within GROUP	6.7%	.0%	3.3%
	GRADE 1	Count	6	5	11
		% within GROUP	40.0%	33.3%	36.7%
	GRADE 2	Count	6	5	11
		% within GROUP	40.0%	33.3%	36.7%
	GRADE 3	Count	2	5	7
		% within GROUP	13.3%	33.3%	23.3%
Total		Count	15	15	30
		% within GROUP	100.0%	100.0%	100.0%

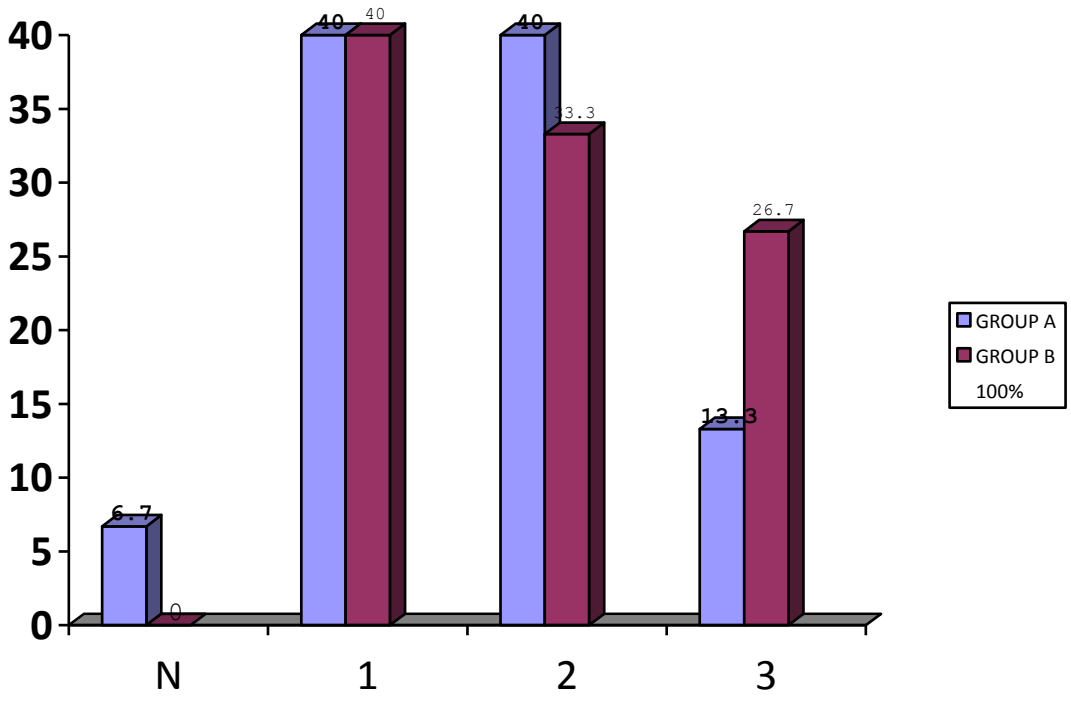
Mann-Whitney U =85.0 ;Z=1.209 P=0.227

The analysis between group –A and group-B was done using Mann-Whitney U test for the result shows are non significant.

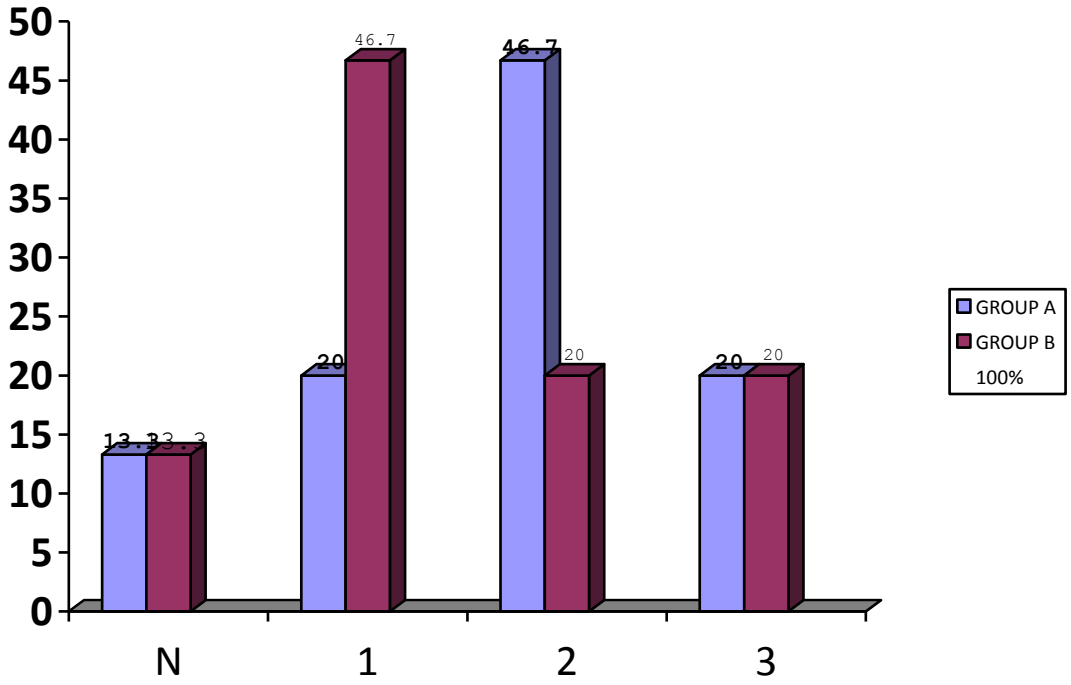
3. Comparison of Group A and Group B Graphical representation of Right feet for Pre testing by using Denis Method



4. Comparison of Group A and Group B Graphical representation of Left feet for Pre testing by using Denis Method

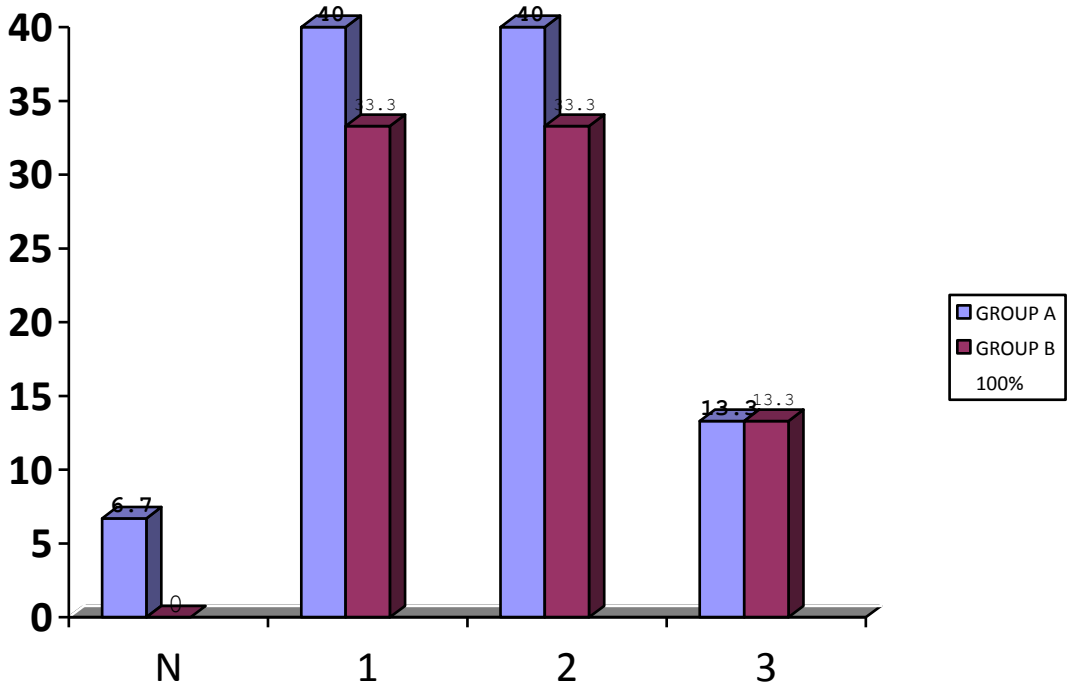


5. **Comparison of Group A and Group B Graphical representation of Right feet for Post testing by using Denis Method**



6. Comparison of Group A and Group B Graphical representation of

Left feet for Post testing by using Denis Method



6.RESULT

- The study sample comprised of 30 childrens. Among 30 childrens,15 were treated with home exercise program and 15 were treated with physiotherapeutic management.

- Independent t-test was used to compare variable,denis method before and after intervention, the score is improve foot posture and strengthening of foot muscles in both groups ($p < 0.05$). The mean score of improve foot posture and strengthening foot muscles is significantly improving in Physiotherapeutic treatment group($p<0.05$).

- The Mann-Whitney U test ,according to denis method grade are non significant .The t-test was used to fore foot and mid foot width (Cm) is significant,according to that result shows there are no significant difference in home exercise program group as compared to physiotherapeutic management group.

- Data analysed and result indicates that physiotherapeutic management has improving foot posture, strengthening of foot muscles, prevent long term musculoskeletal issue and improving of walking pattern for flat feet in children than home exercise program for strengthening exercise for foot muscles and arch activation of foot muscles.

7. DISCUSSION

This was an experimental comparative approach, which studied the effectiveness of home program exercise and physiotherapeutic management to improve foot muscle strengthening and posture of foot for flat feet in children's.

For this study 30 children were recruited. From this sample of 30, the subjects were divided into 2 groups consisting of 15 subject each. The outcome measurement was done by denis method.

On statistical analysis using "t" test, it was found that there is significant difference in the post test scores of Group A over Group B,thus rejecting the null hypothesis.

The Mann-Whitney U test ,according to denis method grade are non significant ,the fore foot and mid foot width (Cm) is significant, according to that result shows there are no significant difference in home exercise program group as compared to physiotherapeutic management group.

Here it can be started physiotherapeutic management is effective in improving foot muscle strengthening ,improving foot posture and improve walking pattern, improve proprioception, balance and prevent long term musculoskeletal issue than home exercise program in pediatric flat feet.

8. CONCLUSION

This study shows results for 30 children's with denis method grade non significant for the short duration of study. The foot width(Cm) will be significant.

From the result, study can be concluded that Physiotherapeutic management exercises has significantly improve foot muscle strength and improve foot posture,prevent lower extremity problem, improve proprioception, balance than home exercise program with pediatric flat feet.

9. LIMITATIONS OF THE STUDY

- Limited Sample size only 30 childrens for this study.
- Age group between 6 - 12years.
- Children's who can able to perform the exercises.
- School going children's 1^{st} standard to 6^{th} standard.

10. SUGGETION FOR THE FUTURE STUDY

- This study has been performed for limited subjects only instead we can perform it for a large group subject also.
- Instead of conducting treatment for 2 months duration of treatment can be performed as long term process.
- This study can also be compared between the Genders.

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12. APPENDIX

SPECIAL TEST FOR FLAT FEET

FEISS LINE TEST

- The Feiss line test is used to measure the fallen medial longitudinal arch.
- Child should be standing with weight distributed evenly.
- A line draw from the medial malleolus to the planter aspect of the 1st
- Metatarso phalangeal joint , used to measure pronation of the foot during weight bearing.
- A positive finding for this test would be the navicular tuberosity dropping below the feiss line.

  There are different grades of flat feet.

Grade 1 – Navicular tuberosity falls 1/3rd of distance from floor.

Grade 2 – Navicular tuberosity falls 2/3rd of distance from floor.

Grade 3 – Navicular tuberosity touch the floor.

APPENDIX

PEDIATRIC FLAT FEET PERFORMA

Child Name :

Age :

Gender :

HISTORY

Family History :

Symptoms :

Trauma :

Activity :

Previous treatment :

OBERVATION

Tender area
-y/n
-site/s

Gait
Barefoot
Shoes on
Limp y/n

Obesity (ok /+/++) :

Observe	Right	Left
Medial arch height(ok/reduced-		
Heel everion(ok/more everted) -		
Heel inversion with tip toe(y/n) -		

Tibial,knee position(med/o/lat) -

Measure	Right	left
Navicular height(mm)		
Fore foot width(cm)		
Mid foot width(cm)		

Consider

Mucle tone, ligament laxity (y/n)

SPECIAL TEST:

Feiss line Test

Measurement Tool:

Tape Measurement

OUTCOME TOOL:

Denis Method

APPENDIX

MEASUREMENT FOR FORE FOOT WIDTH AND MID FOOT WIDTH USING INCH TAPE

	FOREFOOT(cm)					MID FOOT(cm)			
S.NO	**PRE-RT FEET**	**PRE-LT FEET**	**POST-RT FEET**	**POST-LT FEET**	**GROUP**	**PRE-RT FEET**	**PRE-LT FEET**	**POST-RT FEET**	**POST-LT FEET**
1	5.6	5.8	5.5	5.7	GROUP A	4.0	4.3	3.8	4.0
2	6.5	7.0	6.4	7.0	GROUP A	6.6	3.5	6.4	3.2
3	7.4	7.5	7.3	7.3	GROUP A	3.7	4.0	3.6	3.8
4	5.0	5.3	4.8	5.1	GROUP A	5.8	5.3	5.2	5.0
5	4.4	4.4	4.1	4.0	GROUP A	2.5	2.5	2.2	2.2
6	5.0	5.2	4.7	4.9	GROUP A	5.2	5.0	4.7	4.9
7	5.5	5.2	5.3	5.0	GROUP A	5.5	5.5	5.3	5.2
8	4.3	6.5	4.2	6.4	GROUP A	2.0	4.3	2.0	3.8
9	5.7	5.8	5.7	5.6	GROUP A	4.4	5.8	3.8	5.6
10	6.6	6.5	6.5	6.4	GROUP A	6.6	3.8	6.5	3.4
11	5.4	5.4	5.2	4.8	GROUP A	4.2	5.4	4.0	4.8
12	7.6	7.2	7.4	7.2	GROUP A	7.9	6.2	7.7	5.3
13	4.4	5.0	4.1	4.8	GROUP A	2.2	5.5	2.1	5.3
14	4.5	5.5	4.3	5.3	GROUP A	4.5	3.8	4.3	3.6
15	7.5	7.4	7.3	7.1	GROUP A	5.4	5.8	5.2	5.5
16	7.9	7.5	6.7	5.9	GROUP B	4.8	7.5	3.6	5.4
17	7.5	7.5	6.3	6.6	GROUP B	7.8	7.5	6.8	6.6
18	6.8	6.0	6.1	5.4	GROUP B	5.0	4.5	4.2	3.8
19	5.5	5.2	5.2	4.2	GROUP B	5.0	5.5	4.2	4.6
20	4.5	4.4	3.8	3.8	GROUP B	4.5	4.8	3.8	4.1
21	5.0	5.5	3.8	4.2	GROUP B	5.5	5.5	4.5	4.2
22	2.5	2.0	2.1	2.0	GROUP B	3.5	2.5	2.8	2.1
23	6.5	6.5	5.2	5.2	GROUP B	3.0	3.8	2.4	2.8
24	6.0	6.0	5.1	5.1	GROUP B	4.0	3.8	2.8	2.8
25	6.7	6.7	4.9	4.9	GROUP B	4.2	6.9	2.8	4.9
26	5.5	5.5	3.8	4.1	GROUP B	5.5	5.5	3.8	4.4
27	7.5	7.5	6.0	6.3	GROUP B	3.5	4.0	2.8	3.2
28	7.6	7.6	6.4	6.4	GROUP B	5.5	7.5	4.2	6.4
29	5.5	5.5	5.0	4.5	GROUP B	3.5	5.8	3.2	5.0
30	4.0	4.0	3.2	4.2	GROUP B	4.0	3.2	3.2	2.9

PEDIATRIC FLAT FEET

MEASUREMENT OF RIGHT AND LEFT FORE FOOT
MEASUREMENT OF RIGHT AND LEFT MID FOOT

APPENDIX

INFORMED CONSENT

CONSENT FORM

This is to certify that I _____ freely and voluntarily agree to participate in the study "A COMPARATIVE STUDY ON PHYSIOTHERAPEUTIC MANAGEMENT FOR PEDIATRIC FLAT FEET"

I have been explained about the procedures and the risk that would occur during study.

Participant :

Witness :

Date :

I have explained and defined the procedure to which the subject has consented to participate.

Researcher :

Date :